



**SCREENING LEVEL RISK ANALYSIS OF PREVIOUSLY
UNIDENTIFIED ROTENONE FORMULATION CONSTITUENTS
ASSOCIATED WITH THE TREATMENT OF LAKE DAVIS**

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REVISIONS TO SEPTEMBER 7, 2007 DOCUMENT

This updated version of “Screening Level Risk Analysis of Previously Unidentified Rotenone Formulation Constituents Associated with the Treatment of Lake Davis” provides clarification and editorial corrections to the September 7, 2007 document; none of these changes affects the substance of the risk analysis or its conclusions. A Table of Contents has been added to assist the reader in navigating through the document. Clarification has been added to describe how the fatty acid ester mixture component was derived when specific concentrations were not measured in the laboratory (see Page 3 discussion of fatty acid ester component and Table 3). In addition, footnotes that were inadvertently omitted from Table 2 in the September 7, 2007 document have been added. The September 7, 2007 document incorrectly stated that the risk assessment used the proportion of the FenneDefo 99™ ingredient as disclosed on the MSDS. This error was a carry-over from an earlier draft that was not identified during editing. Rather, the assessment uses the average amount of FenneDefo 99™ as determined in the CDFG laboratory analysis. Table 3, footnote 4 has been updated to reflect this correction. Further clarification has been provided through the addition of specific website references in the footnotes so that the reader can obtain them more easily. Finally, updated information has been provided about the CDFG analysis for benzene sulfonic acid, an ingredient that is listed on the European Commission MSDS, but was not detected in lots to be used in Lake Davis and hence it was not discussed. The laboratory certified results supporting this conclusion have now been added (see Attachment 1e).

EXECUTIVE SUMMARY

The ecological and human health risks from the rotenone treatment of Lake Davis and its tributaries to eradicate northern pike were evaluated in the Environmental Impact Report/Impact Statement (EIR/EIS) EIR/EIS prepared jointly by the California Department of Fish and Game (CDFG) and the US Forest Service (USFS)¹. In that report, ecological and human health risks of the chemicals in the rotenone formulations that were being considered for use were evaluated based on samples of the formulations that were independently analyzed in 2004. The results of that risk assessment and the analysis of the environmental impacts in the EIR/EIS led CDFG to select the rotenone formulation CFT Legumine™® (hereafter, CFT or CFT Legumine™). In Master Response EE in Appendix K (Public Comments and Responses) of the EIR/EIS, CDFG and USFS committed to conducting analyses of the actual rotenone formulation lots that will be used to treat the reservoir and tributaries upon receipt of the lots from Prentiss Inc., the manufacturer. Although CFT is approved for use by both the U.S. Environmental Protection Agency and the California Department of Pesticide Regulation (CDPR), these analyses were done to address the public's concerns and desire to know what chemicals are being used for the project. As such, the analyses are intended to identify and quantify chemicals that were not detected in the samples of rotenone formulations that were analyzed for the EIR/EIS. The objective of CDFG and USFS in conducting these additional analyses is to ensure that constituents that were not detected in the sample lots analyzed for the EIR/EIS are examined for their potential human and ecological health risks prior to release. This supplemental report summarizes the findings of that risk assessment.

To evaluate potential human health and ecological risks we screened the maximum estimated concentrations of the constituents in environmental media expected from the treatment after dilution in the reservoir against existing regulatory criteria, guidance values, or literature-based toxicity thresholds—consistent with the methods applied for the EIR/EIS. Regulatory criteria recognized by the State of California were first considered if specified and pertinent to the exposure scenarios envisioned in the EIR/EIS. If no regulatory criteria were specified, then other guidance values or literature values were used as available and appropriate. In addition, this supplemental risk assessment evaluates whether the potential discharge of the new constituents would adversely affect existing beneficial uses recognized by the Central Valley Regional Water Quality Control Board in violation of the Basin Plan. As stated in Resolution No. 88-63, it is state policy that, “all waters, with certain exceptions, should be considered suitable or potentially suitable for municipal or domestic supply (MUN).” Further, while not specified in the Basin Plan for the Middle Fork Feather River, Big Grizzly Creek, a tributary of the Middle Fork, has additional recognized beneficial uses, including: agricultural irrigation and stock watering (AGR), non-contact water recreation (REC-2), warm and cold freshwater habitat (WARM, COLD), cold water spawning (SPWN) and wildlife habitat (WILD). The Middle Fork Basin Plan allows the Regional Water Quality Control Board, after compliance with CEQA, to permit short-term variances from Basin Plan provisions if determined to be necessary to implement control measures for fishery management conducted under statutory requirements of CDFG. CDFG certified the EIR/EIS for this project, which documents the necessity of the project for

¹ Lake Davis Pike Eradication Project, Final EIR/EIS, The Resources Agency California Department of Fish & Game, and U.S. Forest Service, Pacific Southwest Region. SCH #2005-09-2070.

fishery management purposes. As recognized in the EIR/EIS and the National Pollution Discharge Elimination System (NPDES) permit², this project will result in short term excursions outside of the Basin Plan provisions for Lake Davis and its tributaries and downstream for a limited distance in Big Grizzly Creek but is nonetheless consistent with the Basin Plan. Given the existing NPDES permit for the reservoir treatment did not consider the new constituents recently identified, this supplemental report also considers the environmental fate and transport of the additional constituents, and whether their properties could lead to environmental persistence and hence the potential downgrading of the beneficial use standards recognized in the Basin Plan.

To address the objectives outlined in the preceding paragraph, each of the seven lots of the CFT Legumine™ received from the manufacturer for the treatment of Lake Davis and its tributaries were analyzed to evaluate their constituents. Each lot was analyzed by gas chromatography/mass spectrometry using standardized EPA protocols. These methods are applied in sequence to identify the chemicals in the formulation and allow for an interpretation of their concentrations. In addition to the constituents identified previously in the CFT Legumine™ sample analyzed for the EIR/EIS, two classes of constituents were found that were not previously identified: polyethylene glycols (PEGs) and the solvent (alcohol) hexanol. In addition, several new benzene-based constituents were identified.

Prentiss, Inc., the manufacturer of the CFT Legumine™ (for which CWE Properties, Ltd. [Greeley, CO] holds the product registration) explained that the PEGs are part of the inert additive “Fennodefo 99™” in the CFT, which also contains fatty acid esters. Based on verbal communications with the manufacturer, the fatty acid ester mixture in Fennodefo 99™ is likely derived from ‘tall oil’. Tall oil has been independently reported as a mixture of naturally occurring fatty acids, resin acids and neutrals³ that are a by-product of wood pulp, and is a common constituent of soap formulations. The fatty acids in tall oil—principally oleic and linoleic - are naturally occurring constituents that are also part of the building blocks that make up fats and oils (triglycerides). The resin acids are associated with the wood sap. Highly unsaturated fatty acids, like linoleic, are considered essential dietary constituents in humans, as they cannot be synthesized. Polyethylene glycols (e.g., propylene glycol) are common ingredients in a variety of consumer products, including soft-drink syrups (as an antioxidant), in plasticizers, suntan lotions and antifreeze, among other uses. The Fennodefo 99™ constituent in the CFT Legumine™ facilitates emulsification and dispersion of the otherwise relatively insoluble rotenone.

Five distinct PEGs were quantifiable in the lot analyses and their concentrations, once diluted in the reservoir, would approximate 0.3 to 4.3 parts per billion (µg/L), depending on the PEG (Table 2). Trace amounts of longer chain glycols were also identified, but were below reporting limits of the analysis. Independent analyses of the fatty acid esters in the formulation are not currently available, so the total amount of fatty acid esters in the formulation was estimated to approximate 164 µg/L upon dilution of the emulsifier in the reservoir. This estimate was derived by subtracting the measured concentration of the PEGs in the Fennodefo 99™ from the total

² http://www.swrcb.ca.gov/rwqcb5/adopted_orders/Plumas/R5-2007-0053.pdf

³ European Commission. 2000. IUCLID Dataset; Substance ID 61790-12-3.

amount of Fennodefo 99™ that was measured, as reported in Table 1. Several different substituted benzenes were identified and quantified that were not identified or quantified in the sample analyzed and considered for the EIR/EIS. These included tetramethylbenzene and diethylbenzene, which were detected below the method reporting limits at a concentration that would respectively equate to a maximum of 0.37 and 0.45 parts per billion in the reservoir during treatment. In addition to these constituents, additional C4 and C5 substituted benzenes were identified that amounted to an estimated maximum concentration of 2.6 and 0.8 parts per billion, respectively, in the reservoir upon dispersion of the CFT Legumine™ for the treatment.

Concerns about risks to the environment include whether or not these constituents are toxic to wildlife, how rapidly they break down in the environment, and whether or not they build up in the food chain. None of the constituents identified are considered persistent in the environment nor will they bioaccumulate. The trace benzenes identified in the solvent mixture of CFT Legumine™ will exhibit limited volatility and will rapidly degrade through photolytic and biological degradation mechanisms. The PEGs are highly soluble, have very low volatility, and are rapidly biodegraded within a matter of days. The fatty acids in the fatty acid ester mixture (Fennodefo99™) do not exhibit significant volatility, are virtually insoluble, and are readily biodegraded, although likely over a slightly longer period of time than the PEGs in the mixture. None of the new compounds identified exhibit persistence or are known to bioaccumulate.

Under conditions that would favor groundwater exchange the highly soluble PEGs could feasibly transmit to groundwater, but the concentrations in the reservoir, and the rapid biodegradation of these constituents makes this scenario extremely unlikely. Based upon a review of the physical-chemistry of the chemicals identified, we conclude that they are rapidly biodegraded, hydrolyzed and/or otherwise photolytically oxidized and that the chemicals pose no additional risk to human health or ecological receptors from those identified in the earlier analysis. None of the constituents identified appear to be at concentrations that suggest human health risks through water, or ingestion exposure scenarios and no relevant regulatory criteria are exceeded in estimated exposure concentrations.

1.0 INTRODUCTION AND METHODS OVERVIEW

The following screening level hazard and risk assessment was written in accordance with the procedures followed for the EIR/EIS (Appendix J). Thus, we briefly summarize the known toxicity and environmental fate of the constituents (hazard or ‘toxicity’ assessment), the potential exposure scenarios based on the environmental properties of the constituents (exposure assessment) and, if appropriate, the comparison of estimated exposure concentrations to regulatory and/or toxicity criteria (risk characterization). The assessment here is necessarily truncated from that which is provided in Chapter 14 and Appendix J of the EIR/EIS, focusing particularly on conclusions, without repeating some elements of foundation and methodologies that are already fully explained in the EIR/EIS. If the nature of the newly identified constituents was considered benign after the hazard and/or exposure assessment, then a qualitative risk characterization was concluded at this stage. The conclusion of this report summarizes the environmental significance of the characterized risks, as was summarized in Chapter 14 of the EIR/EIS, and the same metrics for risk were applied.

2.0 TOXICITY HAZARD ASSESSMENT

2.1 Results of CFT Legumine™ Lot Analyses and Estimated Environmental Exposure Concentrations

Each of the seven lots of CFT Legumine™ acquired from the manufacturer for the treatment of Lake Davis and its tributaries were analyzed by standard analytical chemistry methods (EPA Method 8260 and EPA Method 8270)⁴. These methods utilize gas chromatography and mass spectrometry (GC/MS) to determine the presence/absence of the volatile and semi-volatile inert constituents and their concentrations. In addition, rotenone, rotenolone, methyl pyrrolidone, and diethylene glycol monoethyl ether, the major reported constituents of CFT Legumine™ previously analyzed for risk in the EIR/EIS, were analyzed by high performance liquid chromatography (HPLC) and mass spectrometry, using a method developed and validated by Water Pollution Control Laboratory (WPCL) chemists. Data output from these analyses, and Quality Assurance/Quality Control measures are provided as Attachment 1a-d to this memorandum. The major constituents in the CFT Legumine™ were confirmed at concentrations that approximated the concentrations analyzed in the EIS/EIR (Table 1, Attachment 1a).

Table 1. Average percent concentrations of major constituents in CFT Legumine™ lots to be used in Lake Davis and tributaries.¹

Major CFT Formulation Constituent	Rotenone	Rotenolone	Methyl Pyrrolidone	DEGEE ²	Fennedefo 99™
Average Percent of Formulation Among Lots	5.12	0.718	9.8	61.1	17.1
Range in Lots (%)	4.64-5.89	0.43-0.98	8.14-10.8	58.2-63.8	15.8-18.1
EIS/R % ³	6.1	0.75	12.71	80.36	NA

¹ Raw data provided in Attachment 1a; ² diethylene glycol monoethyl ether; ³ percentage of the same constituent as reported in the earlier sample analysis in the EIR/EIS.

As depicted in Table 2, fourteen additional constituents, from a total of 68 constituents that could be characterized from the EPA methods 8260 and 8270 applied, were identified in at least some of the lots analyzed. Two new ‘classes’ of constituents were identified that were not identified in earlier analyses—polyethylene glycols (PEGs), and the solvent (alcohol) 1-hexanol. The PEGs were presumed to be part of an emulsifying agent that is added to the CFT known as Fennodefo 99™. In addition to the PEGs, the European Commission reports that Fennedefo 99™ principally contains a fatty acid ester mixture⁵. In the lots received for the treatment of Lake Davis and tributaries, the Fennodefo 99™ constituent averaged 17.1 percent of the total CFT rotenone formulation (Attachment 1a).

⁴ Test Methods for Evaluating Solid Waste, Physical Chemical Methods, (SW-846), U.S. Environmental Protection Agency.

⁵ European Chemicals Bureau. MSDS Rotenone (CFT Legumin)

Results from analyses of the fatty acid ester mixture in the Fennedfo 99™ are still pending, so the concentration of this mixture was conservatively estimated by subtracting the average measured concentrations of the total PEGs from a separate analysis of Fennedfo 99™ (Table 3, Attachment 1d) from the average concentration of Fennedfo 99™ measured in the seven lots of CFT analyzed (17.1%, *see* Table 1 and Attachment 1a). Notably, none of the solvent constituents identified in the CFT lots were measured at reportable concentrations in the single lot of the emulsifier Fennedfo 99™ that was run through the same chemical analyses as the seven lots of CFT (Table 2; Attachment 1b); only PEG constituents were measured at reportable concentrations (Table 3, Attachment 1d). Based on the measured concentrations of PEGs in the Fennedfo 99™, and the analyzed concentration of Fennedfo 99™ in the CFT lots analyzed (17.1%), the concentration of the fatty acid mixture (which may also contain resin acids and sterols) in the rotenone formulation would approximate 164.1 µg/L after dilution in the reservoir (Table 3).

Three additional substituted benzenes were also consistently identified in each lot at concentrations above the method detection limit that were not identified previously: 1,2,4,5 tetramethylbenzene, 1,2,4 trimethylbenzene, and 1,4 diethylbenzene (Table 2). Two other substituted benzenes that were previously identified but *were not* found in the current lots included 1,3,5 trimethylbenzene, and *sec* butylbenzene. Notably, other c-4 and c-5 substituted benzenes were identified in the current analyses of the CFT lots, but the analytical standards required to classify the specific substituted benzenes were not available, so in lieu thereof, a total quantitation of the substituted benzenes was calculated. As demonstrated in Table 2, the total concentration of c-4 substituted benzenes, upon dilution in the reservoir, would approximate 2.586 µg/L, and the total c-5 substituted benzene concentration would approximate 0.796 µg/L. Thus, the total amount of c4 and c5 substituted benzenes in the formulation would approximate 3.382 µg/L once diluted in the reservoir. By contrast, in the CFT Legumine sample analyzed for the EIS/EIR, the total concentration of benzene-based congeners recorded was 0.091 ppb. The discrepancy is likely due to the lack of quantitation of all the c4 and c5 substituted benzene congeners in the earlier sampling for the EIR/EIS that was done for this current analysis. By comparison, the concentration of substituted benzenes in the Noxfish™ rotenone formulation that was analyzed in the EIR/EIS would have approximated 23.14 ppb once diluted in the reservoir—presuming the lot analysis captured all identifiable benzene constituents.

Table 2. Summary of Chemical Lot Analyses Of CFT Legumine™ to be Used For Lake Davis Pike Eradication Project.

Chemical Analyte	Average Concentration in CFT lots (mg/L) ¹	Range of Concentrations in CFT lots (mg/L)	Amount in lake w/41,500 acre-ft treatment at 1ppm formulation (g)	Estimated Concentration Upon Dilution in Lake Davis (µg/l)	Number of Lots Where Detected Above Method Detection Limit ²	Reliable Quantitative Reporting Limit (mg/L) ³
1,2,4,5-tetramethylbenzene	368.57	330-400	18866.99	0.369	7 of 7	50
m-cymene	ND ⁴	NA ⁵	NA	NA	0 of 7	50
p- cymene	ND	NA	NA	NA	0 of 7	50
o-cymene	ND	NA	NA	NA	0 of 7	50
1,4-diethylbenzene	452.86		23181.68	0.453	7 of 7	50
1,2-diethylbenzene	ND	NA	NA	NA	0 of 7	50
(2,2-dimethylpropyl)-benzene	ND	NA	NA	NA	0 of 7	50
1-methyl-4-tert-butylbenzene	ND	NA	NA	NA	0 of 7	50
pentylbenzene (n-amylbenzene)	ND	NA	NA	NA	0 of 7	50
pentamethylbenzene	ND	NA	NA	NA	0 of 7	50
total c4 substituted benzenes	2586	2300-2900	132376.05	2.586	7 of 7	50
total c5 substituted benzenes	796	710-900	40746.84	0.796	7 of 7	50
1-Hexanol	3600	2200-4000	184282.20	3.6	7 of 7	50
tri(ethylene glycol)	266	24-400	13631.03	0.266	7 of 7	5
tetra(ethylene glycol)	1194	960-1300	61134.89	1.194	7 of 7	50
penta(ethylene glycol)	2471	1800-2700	126511.19	2.471	7 of 7	50
hexa(ethylene glycol)	4386	3200-5000	224502.52	4.386	7 of 7	50
Dichloroethylene, 1,1-	ND	NA	NA	NA	0 of 7	50
MTBE	ND	NA	NA	NA	0 of 7	100
Dichloroethylene, trans 1,2-	ND	NA	NA	NA	0 of 7	50
Dichloroethane, 1,1-	ND	NA	NA	NA	0 of 7	25
Dichloropropane, 2,2-	ND	NA	NA	NA	0 of 7	75
Dichloroethylene, cis 1,2-	ND	NA	NA	NA	0 of 7	75
Bromochloromethane	ND	NA	NA	NA	0 of 7	100

Chemical Analyte	Average Concentration in CFT lots (mg/L) ¹	Range of Concentrations in CFT lots (mg/L)	Amount in lake w/41,500 acre-ft treatment at 1ppm formulation (g)	Estimated Concentration Upon Dilution in Lake Davis (µg/l)	Number of Lots Where Detected Above Method Detection Limit ²	Reliable Quantitative Reporting Limit (mg/L) ³
Chloroform	ND	NA	NA	NA	0 of 7	50
Trichloroethane, 1,1,1-	ND	NA	NA	NA	0 of 7	50
Carbon tetrachloride	ND	NA	NA	NA	0 of 7	50
Dichloropropene, 1,1-	ND	NA	NA	NA	0 of 7	25
Benzene	ND	NA	NA	NA	0 of 7	50
Dichloroethane, 1,2-	ND	NA	NA	NA	0 of 7	75
Trichloroethylene ⁶	7.3	0-29.1	372.22	0.0073	2 of 7	75
Dichloropropane, 1,2-	ND	NA	NA	NA	0 of 7	75
Dibromomethane	ND	NA	NA	NA	0 of 7	100
Bromodichloromethane	ND	NA	NA	NA	0 of 7	50
Toluene	166.7	18.2-355	8531.83	0.1667	6 of 7	50
Trichloroethane, 1,1,2-	ND	NA	NA	NA	0 of 7	100
Tetrachloroethylene	12.8	0-30.5	654.49	0.0128	3 of 7	75
Dichloropropane, 1,3-	ND	NA	NA	NA	0 of 7	50
Dibromochloromethane	ND	NA	NA	NA	0 of 7	100
Dibromoethane, 1,2-	ND	NA	NA	NA	0 of 7	125
Chlorobenzene	ND	NA	NA	NA	0 of 7	50
Ethylbenzene	ND	NA	NA	NA	0 of 7	50
Xylene-m/p ⁶	2.9	0-20	146.26	0.0029	1 of 7	75
Xylene-o	ND	NA	NA	NA	0 of 7	75
Tetrachloroethane, 1,1,1,2-	ND	NA	NA	NA	0 of 7	50
Bromoform	ND	NA	NA	NA	0 of 7	100
Isopropylbenzene	ND	NA	NA	NA	0 of 7	25
Bromobenzene	ND	NA	NA	NA	0 of 7	50
Propylbenzene, n-	ND	NA	NA	NA	0 of 7	50
Trichloropropane, 1,2,3-	ND	NA	NA	NA	0 of 7	50
Tetrachloroethane, 1,1,2,2-	ND	NA	NA	NA	0 of 7	75

Chemical Analyte	Average Concentration in CFT lots (mg/L) ¹	Range of Concentrations in CFT lots (mg/L)	Amount in lake w/41,500 acre-ft treatment at 1ppm formulation (g)	Estimated Concentration Upon Dilution in Lake Davis (µg/l)	Number of Lots Where Detected Above Method Detection Limit ²	Reliable Quantitative Reporting Limit (mg/L) ³
Chlorotoluene, 2-	ND	NA	NA	NA	0 of 7	25
Trimethylbenzene, 1,3,5-	ND	NA	NA	NA	0 of 7	25
Chlorotoluene, 4-	ND	NA	NA	NA	0 of 7	50
Butylbenzene, tert-	ND	NA	NA	NA	0 of 7	75
Trimethylbenzene, 1,2,4- ⁶	30.7	26-35	1572.25	0.0307	7 of 7	50
Butylbenzene, sec-	ND	NA	NA	NA	0 of 7	75
Dichlorobenzene, 1,3-	ND	NA	NA	NA	0 of 7	75
Isopropyltoluene, p-	ND	NA	NA	NA	0 of 7	75
Dichlorobenzene, 1,4-	ND	NA	NA	NA	0 of 7	75
Butylbenzene, n- ⁶	23.6	20-36	1206.61	0.0236	7 of 7	75
Dichlorobenzene, 1,2-	ND	NA	NA	NA	0 of 7	75
Dibromo-3-Chloropropane, 1,2- (DBCP)	ND	NA	NA	NA	0 of 7	125
Trichlorobenzene, 1,2,4-	ND	NA	NA	NA	0 of 7	125
Hexachlorobutadiene	ND	NA	NA	NA	0 of 7	100
Naphthalene ⁶	255.1	229-331	13060.64	0.255	7 of 7	100
Trichlorobenzene, 1,2,3-	ND	NA	NA	NA	0 of 7	100

1: Each of the seven lots to be used in Lake Davis were analyzed by GC/MS. Lot identification codes were as follows: 54257, 54271, 54272, 54281, 54297, 54307, and 54311 analyzed on 8/24/07 by the California Department of Pesticide Regulation; 2: the method detection limit reflects the lowest limit for compound identification, and quantitative results listed are provided for disclosure only—these quantitative estimates are not reliable for risk assessment purposes; 3: the reporting limit represents the lowest reliable detection limit for which quantitative results can be reliably reproduced; 4: not detected at the method detection limit; 5: not applicable; 6: previously detected and analyzed constituents in the EIR/EIS.

Table 3. Chemical Analysis of Fennodefo 99™.

Chemical Name ¹	Undiluted Concentration in Fennodefo 99™ (mg/L) ²	Reporting Limits (mg/L)	Amount (g) In Reservoir If Treating 41,500 Acre-Ft ³	Estimated Concentration Upon Dilution In Lake Davis (µg/L)
tri(ethylene glycol)	1,100	50	11,262	0.220
tetra(ethylene glycol)	5,300	50	54,261	1.060
penta(ethylene glycol)	10,000	50	102,379	2.00
hexa(ethylene glycol)	18,000	50	184,282	3.600
total fatty acid esters, resin acids and neutrals	NA (not measured)	NA	NA	164.115 ⁴
n-butylbenzene ⁵	24	75	245.7	0.005

1: Only identified constituents are reported (see Attachment 1d for full lab results). 2: Results from a single sample of a single lot of Fennodefo 99™ (lot #422264); 3: amount and concentration assumed in reservoir based on the average proportion of the fatty acid mixture in the CFT Legumine™ formulation, as reported in Table 1; 4 estimated by subtracting the total amount of glycols; 5: trace amount below reporting limit identified from 8260 volatiles analysis (Attachment 1d)

2.2 Chemicals of Potential Concern

A short list of the constituents identified in Tables 2 and 3 was assembled for which to further consider toxicity hazards, environmental fate and transport, and potential human and ecological risks. These constituents were considered the ‘chemicals of potential concern’. Several criteria were used to determine whether newly identified constituents should be further evaluated for risk as chemicals of potential concern:

- Constituents that were previously identified and evaluated in the risk assessment conducted for the EIR/EIS were not carried forward for further risk analysis, unless their concentration(s) in the lot analyses was/were significantly greater than that evaluated in the EIR/EIS.
- All remaining constituents that were identified in *any* CFT lot at or above the higher method reporting limit (i.e., not the method detection limit) were evaluated for their risks—whether identified in each CFT lot analyzed or not.
- Constituents detected above the method detection limit, but below the higher method reporting limit were not evaluated for risk unless they were clearly identified *in each CFT lot analyzed*. In such cases, risks were evaluated by assuming a constituent concentration *equal to the method reporting limit*.

Xylene, trichloroethylene (TCE) and tetrachloroethylene were absent in most of the lots currently analyzed (Table 2). These solvents are used to extract rotenone from the derris root initially, and their sporadic occurrence in the lots analyzed indicates their trace presence is due to carry over from this use, and not the purposeful inclusion of these constituents as part of the solvent/emulsification solution in the CFT. Because they were identified only sporadically, and below the method reporting limit, it is extremely unlikely they would be detectable in the post-treatment water quality monitoring program. Further, two of the constituents, xylene and TCE, were measured at concentrations at or below that which they were detected in earlier analysis of the Noxfish™ formulation for the EIR/EIS (Noxfish was the formulation that was *not* selected for use). Notably, the higher concentrations of these two constituents in the earlier Noxfish™

analyses did not indicate significant human health or ecological risk. For these reasons, xylene, TCE and tetrachloroethylene were not carried forward for screening risks.

Similarly, although toluene, *n*-butylbenzene, 1,2,4 trimethylbenzene and naphthalene were consistently detectable in each of the CFT lots currently analyzed, they were measured at concentrations well below those already evaluated in the EIR/EIS in either the CFT or Noxfish™ lots analyzed. Although naphthalene and 1,2,4 trimethylbenzene raised air inhalation concerns with the Noxfish™ formulation, the naphthalene concentration in the CFT formulation analyzed for the EIR/EIS did *not* exceed health-based screening levels, and the anticipated concentration of naphthalene in the current CFT lots is significantly less than that measured in the CFT lots analyzed for the EIR/EIS (0.341 ppb vs .255 ppb). Although the 1,2,4 trimethylbenzene was *not* previously detected in the CFT lots analyzed for the EIR/EIS, it was a significant air inhalation concern for the Noxfish™ formulation due to its relatively high concentration anticipated in the reservoir (9.76 ppb). In the current analyses, 1,2,4 trimethylbenzene was never detected above the method reporting limit, but was always identified above the method detection limit. Even assuming a concentration of 1,2,4 trimethylbenzene at the reporting limit in the undiluted formulation (50 ppm) the maximum anticipated concentration in the reservoir would approximate 0.050 ppb, roughly 2.5 orders of magnitude below the anticipated concentration evaluated in the EIR/EIS for Noxfish™--a concentration that would drop the maximum air concentration well below the air quality thresholds evaluated in the EIR/EIS. Because of these findings, none of the anticipated concentrations of these solvent constituents qualify them as chemicals of potential concern and they are therefore not considered further for risk assessment.

None of the major constituents identified in the current analyses of the CFT Legumine™ lots that were also identified in earlier analyses of the CFT Legumine™ formulation for the EIR/EIS were measured at higher concentrations than previously characterized (Table 1). Thus, no further analysis of these constituents was considered necessary.

Of the remaining constituents, the fatty acid esters, resin acids, glycols, newly identified substituted benzenes, and *l*-hexanol were further evaluated for potential risks. Table 4 reflects the short list of these chemicals of potential concern, and their indexing codes, as recognized by the chemical abstracting service (CAS), the EPA, and/or the California Department of Pesticides Regulation (CDPR).

Table 4. Chemicals Of Potential Concern In CFT Legumine™ Rotenone Formulation That Were Previously Unidentified and Were Further Considered For Their Hazards.

Chemical Name	Estimated Concentration in Lake Davis of Constituents Identified Above Reporting Limit ¹ (µg/L)	CAS ² #	EPA-PC ³ #	CDPR ⁴ Chemical Code
CFT Legumine™® Formulation				
1,2,4,5-tetramethylbenzene	0.368571	95-93-2	NS ⁵	NS
1,4-diethylbenzene	0.45286	105-05-5	NS	NS
total c4 substituted benzenes	2.586		NS	NS
total c5 substituted benzenes	0.796		NS	NS
1-Hexanol	3.6	111-27-3	079047	3229
tri(ethylene glycol)	0.266286	112-27-6	083501	596
tetra(ethylene glycol)	1.194286	112-60-7	NS	NS
penta(ethylene glycol)	2.471429	4792-15-8	NS	NS
hexa(ethylene glycol)	4.385715	2615-15-8	NS	NS
Linoleic Acid ⁶	No data	60-33-3	NS	NS
Oleic Acid ⁶		112-80-1	NS	NS

¹Based on average chemical concentrations from lot analyses summarized in Table 1, at proposed treatment concentration of 1 mg-CFT formulation/L reservoir water. ²Chemical abstract service code; ³The US Environmental Protection Agency (EPA) assigns a unique chemical code number to a particular pesticide active ingredient or mixture of active ingredients. The US EPA PC (Pesticide Chemical) Code is sometimes referred to as the Shaugnessy Number. The US EPA PC code is included in the US EPA pesticide product data. Reference: US EPA Pesticide Product Information System; ⁴The California Department of Pesticide Regulation assigns a unique chemical code number to serve as an identifier for a particular pesticide active ingredient or mixture of active ingredients; ⁵NS = none specified; ⁶two known constituents of fatty acid mixture in Fennodefo 99™, estimated concentration not provided

2.3 Regulatory Screening Criteria of Hazardous Substances

As discussed in the EIR/EIS, a “hazardous material” is defined in Title 22, California Code of Regulations, Section 66084, as “a substance or combination of substances which, because of its quantity, concentration or physical, chemical or infectious characteristics, may either: (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating irreversible illness, or (2) pose a substantial present or potential hazard to human health or environment when improperly treated, stored, transported or disposed of or otherwise managed.

Each of the chemicals of potential concern identified in Table 4 were evaluated to determine to what extent they are recognized in state or federal statutes as hazardous materials, and, if so, their associated regulatory criteria (Table 5). As designated in Table 5, no California-specific or federal regulatory screening values were identified for the protection of human or ecological health for the new constituents in the CFT lots.

Table 5. Regulatory screening values (as recognized) for newly identified rotenone formulation constituents.

Contaminant	MCL ¹	ESL ²	PHGs ³	WQGs ⁴	Prop. 65 ⁵	Air Toxic Hot Spots ⁶	Notes
1-Hexanol	None	None	None	None	None	None	FIFRA ⁷ -Inert
tri(ethylene glycol)	None	None	None	None	None	None	FIFRA-Inert & CAA ⁸
tetra(ethylene glycol)	None	None	None	None	None	None	CAA
penta(ethylene glycol)	None	None	None	None	None	None	
hexa(ethylene glycol)	None	None	None	None	None	None	
Hepta(ethylene glycol)	None	None	None	None	None	None	
octa(ethylene glycol)	None	None	None	None	None	None	
nona(ethylene glycol)	None	None	None	None	None	None	
1,2,4,5-tetramethylbenzene	None	None	None	None	None	None	
1,4-diethylbenzene	None	None	None	None	None	None	
total c4s	None	None	None	None	None	None	
total c5s	None	None	None	None	None	None	
Oleic Acid (representative fatty acid in Fennodefo 99)	None	None	None	None	None	None	RTKs ⁹ (RI & PA) ¹⁰
Linoleic Acid (representative fatty acid in Fennodefo 99)	None	None	None	None	None	None	
Abietic acid (representative rosin acid in Fennodefo 99)	None	None	None	None	None	None	
Pimaric acid (representative rosin acid expected in Fennodefo 99)	None	None	None	None	None	None	

¹ National Primary Maximum Contaminant Level List - <http://www.epa.gov/safewater/consumer/pdf/mcl.pdf>

² Environmental Screening Levels - <http://www.swrcb.ca.gov/rwqcb2/RBSL/ESL%20Web%20Page%20Files/eslziprevised.ZIP>

³ Public Health Goals - <http://www.oehha.ca.gov/water/phg/allphgs.html>

⁴ Water Quality Goals - http://www.swrcb.ca.gov/rwqcb5/available_documents/wq_goals/limit_tables_2007.xls

⁵ Proposition 65 - http://www.oehha.ca.gov/prop65/prop65_list/files/singlelist060107.xls

⁶ Air Toxics Hot Spot List - <http://www.arb.ca.gov/ab2588/final96/guide96a.pdf>

⁷ Federal Insecticide, Fungicide and Rodenticide Act (FIFRA)

⁸ Clean Air Act (CAA)

⁹ Right To Know (RTK)

¹⁰ Rhode Island and Pennsylvania

Polyethylene Glycols

As identified in Table 5, we have not identified any specific regulatory thresholds for the PEGs identified in the CFT lots. When used regularly in industrial settings, PEGs are recognized to have the potential to cause mild eye irritation. If ingested, nausea, vomiting and diarrhea could result. A manufacturer's MSDS⁶ for a product that contains 100% PEGs (Carbowax) indicates, however, that PEGs are a low hazard in usual industrial settings. This finding is reflected in the lack of personal protective equipment required of workers in industrial settings where PEGs are used: with the exception of eye-wear, neither gloves, protective garments, nor respirators are

⁶ <https://fscimage.fishersci.com/msds/19125.htm>

required for use of the chemical, and there are no OSHA vacated PELs listed. PEGs are not considered as hazardous substances, priority pollutants, or toxic pollutants under the Clean Water Act (CWA) or Toxic Substances Control Act (TSCA). PEGs do not contain any hazardous air pollutants or ozone depleters.

The Vermont Health Advisory (VHA), however, has identified the maximum safe concentration for ethylene glycol in drinking water at 7000.0 ppb. The VHA is a researched and calculated concentration of a chemical in drinking water provided in instances where the chemical does not have an MCL⁷

Fatty Acids and Resin Acids

No regulatory values for the protection of environmental health were identified for these natural compounds in water, air, or sediments.

Substituted Benzenes

The term ‘substituted benzenes’ as applied in this assessment includes all compounds with a benzene ring that is bonded to one or more alkyl groups on the benzene ring. The c4 and c5 substituted benzenes refers to the number of carbons in the attached alkyl group(s), not the position of substitution on the aromatic ring. Of the new substituted benzene constituents identified, no regulatory values for the protection of environmental health have been established that would be reflective of the exposure conditions evaluated for the EIR/EIS. Further, no indices for ‘total c4 or c5 substituted benzenes’ have been established. As discussed, the concentration of all substituted benzenes combined is substantially below that previously evaluated in the EIR/EIS for the Noxfish™ formulation.

2.4 Environmental Fate, Persistence and Toxicity

Some of the physical and chemical properties and toxicity information available on the newly identified rotenone formulation constituents are summarized in Table 6. Many of these properties provide for the prediction of environmental fate, transport and persistence. Text below expands on some of these findings for the constituents of potential concern, and provides a description of some relevant literature.

Polyethylene Glycol Constituents

Fate

All of the PEG derivatives identified in the CFT lots are assumed to have been derived from the Fennodefo 99™ emulsifying agent. Triethylene glycol and the other PEG constituents identified are readily miscible in water and can be expected to rapidly degrade in surface waters (Table 6). Because of their high solubility, PEGs can be considered mobile in soils and would be presumed to be poorly adsorbed to sediments. They are stable to abiotic degradation hydrolysis and soil

⁷ Vermont Department of Health Drinking Water Guidance, Health Protection Division, December 2002.
www.healthvermont.info/enviro/water/documents/drinkingwaterguidance02.pdf

and aquatic photolysis but are rapidly biodegraded. The final breakdown products of PEGs are carbon dioxide and water. Ethylene glycol is presumed to be an intermediate breakdown product of longer-chained PEGs.

The biodegradation in water of tetraethylene glycol (TREG), triethylene glycol (TEG), diethylene glycol (DEG), and ethylene glycol (EG) was evaluated as part of a study in 2000 of glycol-based dehydration units used in the natural gas industry.⁸ The predominant constituents in the solutions were TEG and EG, which were typically present within a range of 50%-92% by weight. Solutions from three different geographic locations were incubated at room temperature and agitated for a period of 30 days. Degradation of the glycols (i.e., breakdown of a compound to its mineral components [carbon dioxide and water]) occurred at 100% (i.e., complete mineralization), 96%, and 39% at the three locations, respectively. Not surprisingly, the literature indicates the breakdown products of TEG to display low or no toxicity.

These results are consistent with a 1974 study that evaluated the biodegradation of TEG, DEG, and EG in river waters.⁹ Solutions from four different river sources were tested at three different glycol doses at three different temperatures. EG degradation was complete (100% mineralization) after 3-14 days. TEG and DEG degradation varied between partial and complete over a period of 4-14 days.

Additionally, complete EG degradation was shown under both aerobic and anaerobic conditions to occur between 24 hours and 28 days under a series of studies summarized by Staples et al. 2001.¹⁰ Collectively, the data show that EG does not persist in air, surface water, soil, or groundwater, is practically non-toxic to aquatic organisms, and does not bio-accumulate in aquatic organisms and has no MCL (Table 4). Acute aquatic toxicity values (LC50s and EC50s) for ethylene glycol were generally >10,000 mg/l--considered practically non-toxic, according to EPA criteria (the same criteria used for the EIR/EIS).

Toxicity and Estimated Exposure

Through a review of open literature data as part of a Reregistration Eligibility Decision, the US EPA concluded that triethylene glycol (TEG) posed no ecological risk concerns for non-target organisms. They confirmed the low toxicity of the compound to fish and aquatic invertebrates, and concluded that TEG would have no effect to listed species and critical habitat and therefore made a "No Effect" determination for TEG.¹¹

The EPA has no risk concerns for TEG with respect to human exposure. TEG is of very low toxicity by the oral, dermal, and inhalation routes of exposure. There are no indications of special sensitivity to infants or children resulting from exposure to TEG. At the total concentrations that could be realized in Lake Davis, there is essentially no risk to human health.

⁸ <http://www.osti.gov/energycitations/servlets/purl/824956-7TVHX2/native/824956.pdf>. "JV Task 3-Gas Industry Groundwater Research Program, Final Report." October 2000. Sorensen, J.A. et al. 2000-EERC-10-04.

⁹ Evans, W.H., and David, E.J., 1974. "Biodegradation of Mono, Di-, and Tri Ethylene Glycols in River Water Under Controlled Laboratory Conditions." Water Resources. Vol. 8, p. 97-100.

¹⁰ Staples, C.A., Williams, J.B., Craig, G.R., and Roberts, K.M. 2001. "Fate, Effects, and Potential Environmental Risks of Ethylene Glycol: A Review. Chemosphere, Vol. 43, p. 377-383.

¹¹ http://www.epa.gov/oppsrd1/REDs/triethylene_glycol_red.pdf. "Reregistration Eligibility Decision (RED) for Triethylene Glycol September 2003." EPA 739-R-05—002 September 2005.

Table 6. Physical and chemical properties and toxicity of newly identified rotenone formulation constituents in CFT Legumine™.

Ingredient	MW (g/mol)	Boiling Pt (°C)	Water Solubility (mg/L @ 25oC)	Vapor Pressure (torr @ 25°C)	Vapor Density (Vd = PM/RT)2	Henry's Law Constant (atm- m3/mol)	Specific Gravity	Log Octanol/ Water Partition Coefficient	Half- Lives ³	Air Pollution Factors ⁴	Odor Thresholds and Character- istics	Water Pollution Factors	Aquatic Toxicity Metrics	Toxicity to Other ⁵ Receptors
SOLVENTS														
1-Hexanol	102.2	158	5,900 mg/l@20d egrees C	0.98 mm @ 20 degrees C	3.52		0.82			1 mg/cu m=0.24 ppm; 1 ppm=4.25 mg/cu m	odor: sweet alcohol	BOD: 28% of ThOD; COD: 94% of ThOD		LED50 orally in rats: 4.59 g.kg. Toxicity threshold (cell multiplication inhibition test): bacteria (Pseudomonas putida): 62 mg/l; algae (Microcystis aeruginosa): 12 mg/l; green algae (Scenedesmus quadricauda): 30 mg/l; protozoa: (Entosiphon sulcatum): 75 mg/l; protozoa (Uronema parduczi Chatton-Lwoff: 93 mg/l
1,2,4,5- Tetramethylbenz ene	134.2	196.8	33.9	0.118	0.000852	0.00799	0.84	4.0	Aqueous volatilization: est. 3.5 hrs for model river, 4.6 days for model lake					
1,4- diethylbenzene	134.2	183.7	17	0.92	0.006646	0.00755		4.06	Aqueous volatilization: est. 3.5 hrs for model river, 4.6 days for model lake					
POLYETHYLENE GLYCOLS														
Triethylene Glycol	150.2	285	easily soluble in cold water	<0.001 mm @ 20 degrees C	5.17		1.1@20C/ 4C			1 ppm=6.14 mg/cu m	practically odorless	BOD5: 0.03 NEN 3235- 5.4, 1.4% of ThOD; BOD10: 0.50 std.dil.sew.; 10 days: 3.7.% of ThOD; 15 days:11.5% of ThOD; 20 days: 17.0% of ThOD; COD: 1.57 NEN 3235- 5.3	LC50/96-hour values for fish are between 10 and 100 mg/l. Therefore, this material is expected to be slightly toxic to aquatic life.	LD 50 Oral mice, rats (g/kg): 21, 15-22; Toxicity threshold (cell multiplication inhibiton test) in mg/l: bacteria (Pseudomonas putida): 320; algae (Microcystis aeruginosa): 3600; protozoa (Entosiphon sulcatum). Goldfish: 24 hr LD50=>5,000 mg/l; guppy: 7 d LC50: 62,600 ppm. Single oral doses LD 50: Guinea pig: 14.6 g/kg; 7.9 ml/kg. Rat (repeated oral dose): no effect@3-4 g.kg/day, 2 years, 5-8 g.kg.day, 30 days; Man: very low acute and chronic toxicity

Screening Level Risk Analysis of Previously
Unidentified Rotenone Formulation Constituents
Associated with the Treatment of Lake Davis

Ingredient	MW (g/mol)	Boiling Pt (°C)	Water Solubility (mg/L @ 25°C)	Vapor Pressure (torr @ 25°C)	Vapor Density (Vd = PM/RT) ²	Henry's Law Constant (atm- m ³ /mol)	Specific Gravity	Log Octanol/ Water Partition Coefficient	Half- Lives ³	Air Pollution Factors ⁴	Odor Thresholds and Character- istics	Water Pollution Factors	Aquatic Toxicity Metrics	Toxicity to Other ⁵ Receptors
Tetraethylene Glycol	194.2	327	Fully miscible in water	0.001 mm @ 20 degrees C	6.7		1.12				Faint amine odor	BOD10: 0.50 std. dil.sew.		Rats: single oral LD50: 32.8 g/kg, and 28.9 ml/kg-1; Rabbit: skin LD 50>20,000 mg/kg
Pentaethylene Glycol	238.3	338-340					1.126							
Hexaethylene Glycol		217 @ 4 mm Hg	Fully miscible in water				1.127				Not determined			Oral Rat LD50: 32,000 mg/kg-1; Oral Guinea Pig: 20,000 mg/kg-1
REPRESENTATIVE ROSIN ACIDS														
Abietic acid	302.4	250 @ 9 mm Hg	insoluble											LC50 values to crustaceans: 6.2 mg/l=96 hr, <i>Nitocra spinipes</i> ; LC50 values in fish: 0.56 mg/l=96 hr, <i>Oncorhynchus kisutch</i> (i.e., coho salmon); 0.7 mg/l=96 hr, <i>Salmo gairdneri</i> ; 0.41 mg/l=96 hr, <i>Oncorhynchus kisutch</i> .
Beta-Pinene	136.2	167		2 mm Hg @! 20 degrees	4.7	0.049 mol/kg*bar								
Isopimaric Acid	302.5		26 mg/mL											LC50=0.4 mg/l for rainbow trout for isopimaric acid in lodgepole pine sapwood (Wang, Z. et al. Jan.1995, Applied & Env. Microbiol.).
FATTY ACIDS														

Screening Level Risk Analysis of Previously
Unidentified Rotenone Formulation Constituents
Associated with the Treatment of Lake Davis

Ingredient	MW (g/mol)	Boiling Pt (°C)	Water Solubility (mg/L @ 25°C)	Vapor Pressure (torr @ 25°C)	Vapor Density (Vd = PM/RT) ²	Henry's Law Constant (atm- m ³ /mol)	Specific Gravity	Log Octanol/ Water Partition Coefficient	Half- Lives ³	Air Pollution Factors ⁴	Odor Thresholds and Character- istics	Water Pollution Factors	Aquatic Toxicity Metrics	Toxicity to Other ⁵ Receptors
Tall Oil		160- 210 at 6.6 hPa	virtually insoluble in water	negligable at 25 deg C				4.89-5.98 at 25 deg C					Fish: Semistatic; 96 hour exposure; NOEC ≥1000mg/L Invertebrates: (Crustacea); 48 hour exposure; NOEC ≥1000mg/L Plants: (Algae); 72 hour exposure; NOEC ≥1000mg/L	Oral: LD50, Rat @ 74000 mg/kg bw (Oleic) LD50 Rat @ >3200 mg/kg bw (linoleic) LD50, Rat @ 7600 mg/kg bw (Rosin) Skin: Rabbit, Slight Irritant Eye: Rabbit, Slight irritant
Oleic Acid (112- 80-1) <Tall Oil Partition>	282.5	360 deg C	Insoluble	1 mm Hg @ 177 deg C	9.7 (air=1)		0.895 (water=1)				rancid odor (Lard like)		Fish: Fathead Minnow: LC50 = 205 mg/L; 96 Hr.; Static condition	LD50/LC50: Draize test, rabbit, eye: 100 mg Mild; Oral, mouse: LD50 = 28 gm/kg; Oral, rat: LD50 = 25 gm/kg; Human Skin Draize 15 mg/3D intermittent; REACTION: Moderate.
Linoleic Acid (60-33-3) <Tall Oil Partition>	280.4	229 - 230 deg C @ 16.00m m Hg	Insoluble				0.9020g/c m ³					COD: 8.38% of ThOD BOD: 71% of ThOD	Invertebrate toxicity: EC50 (duration unspecified) purple sea urchin 0.28- 1.07 mg/kg inhibited fertilisation (Cherr, G.N. et al Environ. Toxic ol. Chem. 1987, 6(7), 561-569).	Oral, mouse: LD50 = >50 gm/kg

Screening Level Risk Analysis of Previously
Unidentified Rotenone Formulation Constituents
Associated with the Treatment of Lake Davis

Ingredient	MW (g/mol)	Boiling Pt (°C)	Water Solubility (mg/L @ 25°C)	Vapor Pressure (torr @ 25°C)	Vapor Density (Vd = PM/RT) ²	Henry's Law Constant (atm- m ³ /mol)	Specific Gravity	Log Octanol/ Water Partition Coefficient	Half- Lives ³	Air Pollution Factors ⁴	Odor Thresholds and Character- istics	Water Pollution Factors	Aquatic Toxicity Metrics	Toxicity to Other ⁵ Receptors
Linolenic (463-40-1) <Tall Oil Partition>	278.4	230 - 232 deg C @ 1 mm Hg	Insoluble		9.6									

¹ Calculated based on a 1 ppm concentration in treatment.

² P is the equilibrium vapor pressure in atmospheres; R = 0.082 liter atmospheres/mol/K; M = gram molecular weight; T = absolute temperature in degrees Kelvin.

³ Model river assumes depth = 1 m, flow velocity = 1 m/sec, and wind velocity = 3 m/sec. Model lake assumes depth = 1 m, flow velocity = 0.05 m/sec, and wind velocity = 0.5 m/sec. Do not consider sediment particulate adsorption.

⁴ ppm = (W/V)/(RT/pm^{10⁶}), where ppm = parts per million (volume) of pollutant per million volumes air; W = weight of pollutant; R = 0.08205 l-atm/molK; T = absolute temperature in degrees Kelvin = 293.16K (i.e., 20°C); p = 1 atmosphere pressure; m = molecular weight.

⁵ Refer to Verschueren, K. 1983. *Handbook of Environmental Data on Organic Chemicals, Second Edition*, New York: Van Nostrand Reinhold and Merck & Co., Inc., 1989. *The Merck Index – An Encyclopedia of Chemicals, Drugs, and Biologicals, Eleventh Edition – Centennial Edition*.

Fatty Acids and Rosin Acids

Fate

Information on the precise proportions of the fatty acid esters in the emulsifying agent Fennodefo 99™ that is added to the CFT Legumine™ is not currently available. Further, the source of the fatty acid ester mixture in the Fennodefo 99™ is also not reported. Thus, while it is likely derived from tall oil, which has been reported to contain rosin acids and trace neutral plant sterols, this has not been confirmed. Therefore, for the purposes of this screening level assessment, the concentration of fatty acid esters and resin acids (assumed) that is anticipated in the reservoir was estimated from the average concentration of Fennodefo 99™ in the CFT Legumine™ as reported in Table 1. Specifically, the calculation of fatty acid esters made use of the known rotenone formulation dosage to the reservoir (1 ppm), the empirically derived concentration of Fennodefo 99™ within the rotenone formulation (est. 17.1%), and the concentration of mixed glycols in the Fennodefo 99™ reported in the Fennodefo 99™ analysis (Table 2). We assumed that the reported 17.1 percent proportion of CFT Legumine™ as Fennodefo 99™ was accurate as analyzed (Appendix 1a) and that the glycols identified and quantified in Table 3, represented the only additional ingredients in the Fennodefo 99™. Thus, the concentration of fatty acid esters, (including potential rosin acids and neutrals) was then derived by simply subtracting the known total glycol concentration from the projected concentration of Fennodefo 99™ in the reservoir (i.e., 0.171 parts per million Fennodefo™), to yield the estimated concentration of 164.1 parts per billion of total fatty acids, resin acids and sterols presumed to constitute the residual components of Fennodefo 99™.

The character of the fatty acid esters and (potential) resin acids in the Fennodefo 99™ were estimated from information on tall oil, the principal fatty acid mixture used in Fennodefo 99™. Tall oil (CAS 61790-12-3) is a mixture of naturally occurring fatty acids derived from wood pulp (90% or more), rosin acids (up to 10%, but usually less than 3.5%) and neutral sterols (max 3.5%), and is a common constituent of soap formulations¹². Some of the chemical properties recognized in crude tall oil are summarized in Table 7 below. However, the precise chemical composition of tall oil varies with the species of trees used in pulping, and thus with geographical location¹³, so the percentages in the Fennodefo 99™ previously cited, and the chemical properties identified in Table 7, must be considered approximate.

The fatty acids that are presumed to represent the bulk of the fatty acid ester mixture in Fennodefo 99™ (e.g., oleic, linoleic, linolenic) are naturally occurring constituents that are part of the building blocks that make up fats and oils (triglycerides). They are fundamental dietary sources for animals, and structural components of cell membranes and cell walls (plants). Some are considered ‘essential’, meaning they cannot be synthesized endogenously (e.g., linoleic). As the precise distribution of the fatty acid esters is not known, information on linoleic, linolenic and oleic acid is provided in Table 6, e, as these constituents are known to be the predominant fatty acids in other tall oil analyses.

The rosin acid components that may be in the Fennodefo 99 (and hence CFT Legumine) are not expressly known, but can be estimated from distributions identified in fractionated crude tall oil,

¹² IUCLID Dataset, European Commission, Substance I.D. 61790-12-3

¹³ http://en.wikipedia.org/wiki/Resin_acid

where they are principally (~70%) composed of the abietic-type (e.g., abietic, dehydroabietic, neoabietic acids) and pimaric-type carboxylic acids¹⁴ (simplified chemical formulas $C_{20}H_{30}O_2$ or $C_{19}H_{29}COOH$). Commercially, the manufacture of wood pulp grade chemical cellulose using the Kraft™ chemical pulping processes releases these resin acid constituents from rosin. Rosin is a solid form of resin obtained principally from pines by heating fresh liquid resin to vaporize the volatile liquid terpene components. It is semi-transparent and varies in color from yellow to black. At room temperature rosin is brittle, but it melts at stove-top temperatures. These natural resins are water-insoluble mixtures of constituents, many of which have a hydroaromatic structure. Mixtures of these carboxylic acids occur in rosin in nature in the form of tree sap wood rosin and pine oleoresin (pitch), where they are dissolved in natural terpenic hydrocarbons¹⁵.

Table 7. Chemical properties of crude tall oil.

Properties	min	max	value
Density	940	980	kg/m ³ when the temperature is 20°C
Thermal capacity is	1,6	1,9	kJ/kg °K when 20-100°C
Boiling point is	180	230	°C when 5 mm Hg (mercury column).
Viscosity is	4,5	8,0	Pa*s
Flash point	162	221	°C
Ignition point is	215	230	°C
Spontaneous ignition temperature (self-ignition temperature)	304	311	°C

Laboratory and field studies evaluating pulp mill waste streams confirm that the wood-derived resin acids will readily biodegrade under both aerobic and anaerobic conditions in water and sediments, although the rate of degradation appears quite variable depending on site conditions. In water, the complete biodegradation of abietic acid was shown to occur within a 7 day period.¹⁶ Pimaric acid and isopimaric acid were partially degraded over a similar time period. Wilson and colleagues isolated two gram-negative bacteria that grew on the resin acids isopimaric acid, pimaric acid, and dehydroabietic acid, as well as fatty acids under aerobic conditions¹⁷

Under anaerobic conditions, sediment sampled from a reservoir receiving a bleached Kraft™ mill effluent discharge, demonstrated a 50% reduction in total resin acid concentration after a 264 day incubation period.¹⁸

Resin acids in both river waters and sediment associated with a pulp mill were measured, and results indicated variable amounts of degradation of abietic, isopimaric, and pimaric acids, among others. Variations in the water column distributions reflected both degradation of the

¹⁴ *Energy Fuels*, **15** (5), 1166 -1172, 2001. 10.1021/ef010018a S0887-0624(01)00018-4

¹⁵ http://en.wikipedia.org/wiki/Resin_acid

¹⁶ Bicho, P.A., Martin, V., and Saddler, J.N. 1995. "Growth, Induction, and Substrate Specificity of Dehydroabietic Acid-Degrading Bacteria Isolated From A Kraft Mill Effluent Enrichment." *Applied Environmental Microbiology*. V. 61, No. 9, pp. 3245-3250.

¹⁷ Wilson, A.E. J., E.R. Moor and W.W. Mohn. 1996. *Appl. Environ. Microbiol.* 62:9:3146-3151.

¹⁸ Tavendale, M.H., McFarlane, P.N., Mackie, K.L., Wilkins, A.L., and Langdon, A.G. 1997. "The Fate of Resin Acids-2. The Fate of Resin Acids and Resin Acid Derived Neutral compounds in Anaerobic Sediments. *CHEMOSPHERE*. November 1997. Vol. 35, No. 10, pp. 2153-2166.

more labile resin acids and redistribution of the resin acids between aqueous, colloid and sediment phases.¹⁹

Degradation studies have also been conducted on the specific Fennodefo product by the KM Lab (Oslo, Norway). Their degradation studies, conducted under EEC guidelines documented 53% degradation of the test substance after 28 days²⁰. Under EEC guidelines, a test substance is considered to degrade 60% within 28 days, and in these tests the Fennodefo could not meet this standard. However, degradation is complete over a longer period of time, and the constituents in the Fennodefo are not considered persistent. As discussed further above, other constituents in the Fennodefo have exhibited more rapid degradation than identified in the tests by KM labs. In tests of tall oil, 74% degradation was observed after 28 days.

Toxicity and Estimated Exposure

Toxicity tests were also conducted on Fennodefo 99™ by KM Labs, with the standard water flea, *Daphnia magna*²¹ using OECD approved method ISO 6341. The LC50 value found for the test substance after a 48 hr exposure was 16 mg/L, with a 95% confidence interval of 15-17 mg/L. The NOEC value was estimated at 3 mg/L. Based on the LC50 value, Fennodefo would be considered slightly toxic to aquatic organisms using EPA criteria, as specified in the EIR/EIS.

No toxicity measurements are available for other organisms for tests conducted with Fennodefo specifically; however, tests have been conducted with tall oil provide illustrative information for the potential toxicity associated with the contribution of the Fennodefo constituents to the CFT Legumine²². As reflected in Table 6, the 96-hr LC-50 and NOEC for fish, aquatic invertebrates and aquatic plants exposed to tall oil was reported to be greater than 1000 mg/L—practically non-toxic according to EPA criteria. No toxicity data on soil dwelling organisms, terrestrial plants or terrestrial were identified for tall oil (as the mixture). The acute oral toxicity in rats of the fatty acids oleic, linoleic, and the resin acids in tall oil were reported as 74,000, 3,200 and 7,600 mg/kg-bw, respectively, and these factors qualify these constituents as “practically non-toxic” according to EPA criteria used in the EIR/EIS. No inhalation or dermal toxicity data for tall oil were identified in the literature; however, given the lack of significant volatility in the constituents, such risk factors are insignificant. However, undiluted tall oil is reported as slightly irritating to the skin and eyes. No genetic, developmental, or carcinogenic toxicity is recognized in the literature. Tall oil has no exposure limit values identified under occupational exposure scenarios where exposure could be for a much greater duration (and over a life-time) than that possible under the reservoir treatment.

¹⁹ Volkman, J.K., Holdsworth, D.G., and Richardson, D.E. 1993. “Determination of Resin Acids By Gas Chromatography and High-Performance Liquid Chromatography in Paper Mill Effluent, river Waters and Sediments From the Upper Derwent Estuary, Tasmania.” *Journal of Chromatography*. Vol. 643, No. 1-2, pp. 209-219.

²⁰ Confidential KM Lab Report R-232-99

²¹ Confidential KM Lab Report R 186-99,

²² 2000. European Commission; European Chemicals Bureau, IUCLID dataset on substance i.d. 61790-12-3

1-Hexanol

Fate

1-Hexanol (*aka n*-hexanol) is a solvent constituent that was consistently found in the new lots of CFT Legumine™ to be used for the treatment of Lake Davis and its tributaries above method reporting limits. It was not found in the sample of Fennodefo 99™ (Table 3). It is used as a solvent, plasticizer, and intermediate in the textile and leather finishing industry. The compound *n*-Hexanol (CH₃[CH₂]₄CH₂OH) is readily biodegradable in water (1.2 g O₂ uptake/g hexanol in 7 days in river water).²³ Aerobic degradation of 1-Hexanol to its mineral components (carbon dioxide, oxygen, and water) was documented in two discrete studies as 58% complete in 31 days, and 77% complete in 30 days.²⁴

The 58% degradation result was achieved using a saturated mixture of soil and sludge from a domestic wastewater treatment plant. A volume of 20-24 mg of the test substance were added by weight to Teflon vial inserts, which were then placed into their respective flasks. A volume of 30 ml of dichloromethane was then used to dissolve the test substance. The solvent was then evaporated, leaving a film on the bottom of the flask. This was done to increase the bioavailability of the alcohol.

The 77% degradation result was achieved using effluent from a municipal sewage treatment plant, where an initial 6 mg/l concentration of 1-Hexanol was reduced to approximately 2 mg/l in 30 days

Toxicity and Estimated Exposure

Toxicity metrics for *n*-hexanol are identified in Table 6. Aquatic toxicity metrics identified in the variety of aquatic plants and animals would equate the solvent as ‘slightly toxic’ according to EPA criteria. Acute oral toxicity in mammals and birds would qualify the solvent as ‘practically non toxic’, according to EPA criteria used in the EIR/EIS. The estimated concentration in reservoir water would not exceed any of these criteria, nor would ingestion routes of exposure of water by wildlife result in exceedance of toxicity thresholds.

Substituted Benzenes

Fate

As demonstrated in Table 6, the substituted benzenes are rapidly volatilized and photolytically degraded. Specific environmental fate data on the newly identified substituted benzenes were not identified in the literature, but fate data on similarly substituted benzenes was found and explored at great length in the EIR/EIS (see Appendix J, Table 15). As reflected in that table, and in Table 6, volatilization from static waters (including sediments) is extremely rapid, with

²³ <http://www.jtbaker.com/msds/englishhtml/h2607htm>. “Material Data Safety Sheet (MSDS) Hexyl Alcohol.” MSDS Number H2607. J.T. Baker, Phillipsburg, N.J. November 10, 2006.

²⁴ http://iaspub.epa.gov/opptppv/Public_Search.PublicTabs?SECTION=1&epcount=4&v_rs_list=24981585,24981579,25070783,25070806. “High Production Volume Information System (HPVIS).” U.S. Environmental Protection Agency. September 7, 2007.

half-lives ranging from 4 to 5 days, depending on the benzene congener in question. Although biodegradation also contributes to degradation, it would be proportionately insignificant in the aqueous media in which the trace substituted benzenes would be distributed. At the trace concentrations anticipated in the reservoir, benzenes will persist for an extremely short period of time—several days at most.

Toxicity and Estimated Exposure

Specific toxicity information on the newly identified substituted benzenes was not identified in the literature, but could be expected to be similar to the range of toxicities reported for the other substituted benzenes addressed in the EIR/EIS (*see* Table 16, Appendix J). For example, the 96-hr LC50 aquatic toxicity to fish and invertebrates for ethyl benzene ranged from a low of 0.490 mg/L in bay shrimp to a high of 12.1 mg/L. At the low end, this substituted benzene would qualify as ‘moderately toxic’, and “slightly toxic” at the high end. The acute oral toxicity reported for rats for this substituted benzene was 3,500 mg/kg, which would qualify this compound as ‘practically non-toxic’ according to EPA criteria. The concentrations of substituted benzenes realized in the reservoir from the CFT Legumine treatment will not approach any of the toxicity thresholds from ingestion or inhalation exposure routes evaluated in the EIR/EIS.

3.0 RISK CHARACTERIZATION

Consistent with the EIR/EIS, risks from the proposed use of the newly identified hazardous materials are considered adverse and significant if the newly identified constituents would:

- Result in an exceedance of federal or state agency surface or groundwater quality standard or water quality objective (particularly waters that may drain to wetlands or streams) for a chemical found in the rotenone formulations.
- Result in an exceedance of a literature based toxicity reference value (i.e., threshold) for aquatic toxicity in aquatic animals.
- Result in an exceedance of a literature-based toxicity reference value for ingestion and/or inhalation uptake in relevant terrestrial or avian wildlife.
- Result in an exceedance of regulatory guidance or human health based screening level for inhalation risk.
- Expose the public, especially schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) to substantial pollutant concentrations, including those resulting in a cancer risk greater than or equal to one in a million, or a Hazard Index for non-cancerous risk of greater than or equal to 0.1.
- Cause a spill or leak that would contaminate the soil or waters to the extent of eradicating the existing vegetation, inhibiting revegetation, or migrating to other areas and affecting soil and/or aquatic ecosystems via erosion and/or sedimentation.
- Create a potential health hazard or involve the use, production, or disposal of materials in a manner that would be expected to pose a hazard to a wildlife or fish population in the project area (where hazard would be considered likely if the estimated dose received by wildlife receptors exceeds pertinent toxicity reference values).
- Create a potential health hazard or involve the use, production, or disposal of materials that pose a hazard to a special-status species population in the project area.

Threshold of Significance	Risk Characterization of New Constituents
1. Cause exceedance of federal or state agency surface or groundwater quality standard or water quality objective for hazardous materials or priority pollutants as recognized in the California Toxics Rule?	N
2. Result in an exceedance of a non-regulatory literature-based toxicity reference value for aquatic animal toxicity?	N
3. result in an exceedance of regulatory guidance or human health based screening level for air quality or inhalation risk?	N
4. result in an exceedance of a literature-based toxicity reference value for ingestion and/or inhalation uptake in relevant terrestrial or avian wildlife?	N
5. result in an exceedance of a literature-based toxicity reference value for plant toxicity?	N

Threshold of Significance	Risk Characterization of New Constituents
6. expose the public, especially schools, day care centers, hospitals, retirement homes, convalescence facilities, and residences) to substantial pollutant concentrations, including those resulting in a cancer risk greater than or equal to one in a million, or a Hazard Index for non-cancerous risk of greater than or equal to 0.1?	N
7. cause a spill or leak that would contaminate the soil or waters to the extent of eradicating the existing vegetation, inhibiting revegetation, or migrating to other areas and affecting soil and/or aquatic ecosystems?	N
8. create a potential health hazard or involve the use, production, or disposal of materials in a manner that would be expected to pose a hazard to a wildlife or fish population in the Project Area?	N
9. create a potential health hazard or involve the use, production, or disposal of materials that pose a hazard to a special-status species population in the Project Area?	N
10. create a potential human health hazard through the generation of hazardous waste (e.g., dead fish)?	N
11. increases the likelihood of impact to fish, wildlife or human health in the event of an accidental spill of hazardous materials?	N

Key:

A	=	Adverse Impact (NEPA)
B	=	Beneficial Impact (NEPA)
LS	=	Less than Significant Impact (CEQA)
N	=	No Impact (CEQA, NEPA)
SM	=	Significant but Mitigable Impact (CEQA)
SU	=	Significant and Unavoidable Impact (CEQA)

3.1 Suggested Risk Management Elements

Given the lack of persistence and ready degradability of most of the newly identified compounds, it is highly unlikely that constituents discussed in this report will present concerns for water quality or sediment quality, or affect the beneficial uses of Lake Davis waters beyond the period of treatment and forest closure already planned for the project. Although potential impacts would be less than significant, additional voluntary elements could be added to the monitoring program, such as including PEGs in the monitoring of groundwaters based on their high solubility and ready mobility and, if feasible, conduct analysis of resin acids to quantify their proportion of the CFT Legumine solution through the Fennodefo emulsifier, or adding the Fennedefo to the groundwater and surface water monitoring plans.

ATTACHMENTS 1a-1e



**DEPARTMENT OF FISH AND GAME
FISH AND WILDLIFE
WATER POLLUTION CONTROL LABORATORY**

2005 NIMBUS ROAD
RANCHO CORDOVA, CA 95670
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LABORATORY REPORT

Name:	Brian Finlayson	Lab Number:	L-486-07
Agency:	DFG-PIU	Other Number:	P2486, P2479
Address:	1707 Nimbus Rd., Suite F	Date Sampled:	
City:	Rancho Cordova, CA 95670	Date Received:	08/23/07
		Date Completed:	08/26/07
		Index-PCA Code:	

RE: Lake Davis Project - CFT Legumine™ Formulations Analysis Results

RESULTS OF CHEMICAL ANALYSIS:

Sample Identification	Rotenone (%)	Rotenolone (%)	Methyl Pyrrolidone (%)	DEGEE* (%)	Fennedefo 99™ (%)
P2479-1 CFT	5.89	0.763	9.82	60.3	18.1
P2479-2 CFT	5.16	0.435	10.0	61.1	17.9
P2479-3 CFT	5.12	0.619	9.60	58.2	16.5
P2479-4 CFT	4.87	0.977	9.89	59.6	16.3
P2479-5 CFT	5.04	0.734	8.14	63.4	17.3
P2479-6 CFT	5.09	0.764	10.8	63.8	15.8
P2479-7 CFT	4.64	0.732	10.4	61.0	18.0

*Diethylene Glycol Monoethyl Ether

Summary Table

Average	5.12	0.718	9.8	61.1	17.1
Range	4.64-5.89	0.43-0.98	8.14-10.8	58.2-63.8	15.8-18.1
EIS/R %*	6.1	0.75	12.71	80.36	NA

Fennedefo 99™ is an emulsifier in the CFT formulation containing fatty acid esters and polyethylene glycol mix. Analysis of Fennedefo 99™ by HPLC-MS confirmed polyethylene glycols ($-(CH_2-CH_2-O)_n-$) with $n=4-12$. Fatty acid methyl esters were not analyzed due insufficient time to obtain and analyze standards.

In addition to the analyses reported above, the CFT formulation was also screened for benzenesulfonic acid, sodium salt and dodecylbenzenesulfonic acid, sodium salt using LC-MS. Results for this analysis were inconclusive. The analyst needs more time to develop the method. (note 9/14/07: see Attachment 1e regarding benzene sulfonic acid tests)

Lead Pesticide Chemist

Date

Laboratory Director

Date

Rancho Cordova, CA 95670

[illegible]

Attachment 1b

California Department of Fish and Game

Water Pollution Control Laboratory

2005 Nimbus Road

Rancho Cordova, CA 95670

WPCL Lab# Sample Identification Date Collected Date Received Date Extracted Date Analyzed			L-486-07-1 P2479.1 8/23/2007 8/26/2007 8/26/2007 2:29	L-486-07-2 P2479.2 8/23/2007 8/26/2007 8/26/2007 3:37	L-486-07-3 P2479.3 8/23/2007 8/26/2007 8/26/2007 4:44	L-486-07-4 P2479.4 8/23/2007 8/26/2007 8/26/2007 5:51	L-486-07-5 P2479.5 8/23/2007 8/26/2007 8/26/2007 6:59	L-486-07-6 P2479.6 8/23/2007 8/26/2007 8/26/2007 8:40	L-486-07-7 P2479.7 8/23/2007 8/26/2007 8/26/2007 9:47	L-486-07-8 P2486 (Fennodefo 99) 8/23/2007 8/27/2007 8/27/2007 9:49
Method EPA 8260M	MDL	Reporting Limit	ppm (µg/mL)	ppm (µg/mL)	ppm (µg/mL)	ppm (µg/mL)	ppm (µg/mL)	ppm (µg/mL)	ppm (µg/mL)	ppm (µg/mL)
Bromoform	17.8	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isopropylbenzene	4.3	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bromobenzene	10.3	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Propylbenzene, n-	7.8	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trichloropropane, 1,2,3-	12.5	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tetrachloroethane, 1,1,2,2-	14.8	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorotoluene, 2-	6.5	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trimethylbenzene, 1,3,5-	6.0	25	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Chlorotoluene, 4-	8.3	50	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Butylbenzene, tert-	15.5	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trimethylbenzene, 1,2,4-	12.3	50	26.0	26.0	35.0	28.0	32.0	35.0	33.0	0.0
Butylbenzene, sec-	13.3	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichlorobenzene, 1,3-	12.8	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Isopropyltoluene, p-	13.3	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dichlorobenzene, 1,4-	12.8	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Butylbenzene, n-	14.3	75	36.0	23.0	20.0	20.0	22.0	24.0	20.0	24.0
Dichlorobenzene, 1,2-	16.0	75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dibromo-3-Chloropropane, 1,2-(DBCP)	26.5	125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Trichlorobenzene, 1,2,4-	23.0	125	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hexachlorobutadiene	22.0	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Naphthalene	21.8	100	331	253	224	229	284	232	233	0.0
Trichlorobenzene, 1,2,3-	21.8	100	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dibromofluoromethane		% rec	107	106	97	94	108	97	102	105
Dichloroethane-d4, 1,2-		% rec	111	110	102	105	117	108	115	110
Toluene-d8		% rec	106	103	92	93	106	93	97	99
Bromofluorobenzene, 4-		% rec	103	104	96	94	102	96	97	94

Attachment 1c

California Department of Fish and Game

Water Pollution Control Laboratory

2005 Nimbus Road

Rancho Cordova, CA 95670

Method: CFT Substituted Benzenes by GC/MS

Sample Name	L-486-07-1 CFT lot # 54257	L-486-07-2 CFT lot # 54271	L-486-07-3 CFT lot # 54272	L-486-07-4 CFT lot # 54281	L-486-07-5 CFT lot # 54297	L-486-07-6 CFT lot # 54307	L-486-07-7 CFT lot # 54311
Date Acquired:	8/24/2007 11:20	8/24/2007 12:23	8/24/2007 13:19	8/24/2007 14:15	8/24/2007 15:12	8/24/2007 16:08	8/24/2007 17:05
Misc Info:	1:100 dilution	1:100 dilution	1:100 dilution	1:100 dilution	1:100 dilution	1:100 dilution	1:100 dilution
Sample Multiplier:	100	100	100	100	100	100	100
Sample Amount:	1	1	1	1	1	1	1
Matrix:	CFT Legumine	CFT Legumine	CFT Legumine	CFT Legumine	CFT Legumine	CFT Legumine	CFT Legumine

Name	Amount	Amount	Amount	Amount	Amount	Amount	Amount
1,2,4,5-tetramethylbenzene	330	340	370	400	390	400	350
m-cymene	BRL	BRL	BRL	BRL	BRL	BRL	BRL
p- cymene	BRL	BRL	BRL	BRL	BRL	BRL	BRL
o-cymene	BRL	BRL	BRL	BRL	BRL	BRL	BRL
1,4-diethylbenzene	400	410	460	490	480	500	430
1,2-diethylbenzene	BRL	BRL	BRL	BRL	BRL	BRL	BRL
(2,2-dimethylpropyl)-benzene	BRL	BRL	BRL	BRL	BRL	BRL	BRL
1-methyl-4-tert-butylbenzene	BRL	BRL	BRL	BRL	BRL	BRL	BRL
pentylbenzene (n- amylbenzene)	BRL	BRL	BRL	BRL	BRL	BRL	BRL
pentamethylbenzene	BRL	BRL	BRL	BRL	BRL	BRL	BRL

CFT Legumine formulation contained approximately 7 C4-substituted benzene peaks and approximately 13 C5-substituted benzene peaks. Only the compounds for which standards were readily available were quantitated and reported.

BRL = below reporting limit

Surrogate Recovery - surrogates not used. Formulation samples are diluted from stock and not extracted.

Attachment 1d

California Department of Fish and Game

Water Pollution Control Laboratory

2005 Nimbus Road

Rancho Cordova, CA 95670

		L-486-07-1	L-486-07-2	L-486-07-3	L-486-07-4	L-486-07-5	L-486-07-6	L-486-07-7	L-486-07-8
		CFT lot #	CFT lot #	CFT lot #	CFT lot #	CFT lot #	CFT lot #	CFT lot #	Fennodefo99
Sample Name	Solvent Blank	54257	54271	54272	54281	54297	54307	54311	Lot #42264
Date Acquired:	8/24/2007 10:20	8/24/2007	8/24/2007	8/24/2007	8/24/2007	8/24/2007	8/24/2007	8/24/2007	8/27/2007
		11:20	12:23	13:19	14:15	15:12	16:08	17:05	11:26
		1:100		1:100	1:100	1:100	1:100	1:100	1:100
Misc Info:		dilution	1:100 dilution	dilution	dilution	dilution	dilution	dilution	dilution
Sample Multiplier:	100	100	100	100	100	100	100	100	100
Sample Amount:	1	1	1	1	1	1	1	1	1
		CFT		CFT	CFT	CFT	CFT	CFT	
Matrix:	CFT Legumine	Legumine	CFT Legumine	Legumine	Legumine	Legumine	Legumine	Legumine	

Name	Reporting Limits								
	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)	mg/L (ppm)
1-Hexanol	50	2200	3500	3900	4000	4000	4000	3600	BRL
tri(ethylene glycol)	5*	24	310	320	400	250	300	260	1100
tetra(ethylene glycol)	50	960	1100	1300	1300	1300	1200	1200	5300
penta(ethylene glycol)	50	1800	2300	2700	2700	2800	2600	2400	10000
hexa(ethylene glycol)	50	3200	3900	4700	4700	5000	4800	4400	18000

Hepta(ethylene glycol), octa(ethylene glycol) and nona(ethylene glycol) were tentatively identified, by GC/MS library search, in the CFT Legumine formulations. Standards were not readily available for these compounds and they were not quantitated.

5* = tri(ethylene glycol) analyzed and reported at 1:10 dilution. Other compounds were 1:100 dilution.

BRL = below reporting limit

Surrogate Recovery - surrogates not used. Formulation samples are diluted from stock and not extracted.



**DEPARTMENT OF FISH AND GAME
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LABORATORY REPORT

Name:	Brian Finlayson	Lab Number:	L-486-07-BZS
Agency:	DFG-PIU	Other Number:	P2479
Address:	1707 Nimbus Rd., Suite F	Date Sampled:	
City:	Rancho Cordova, CA 95670	Date Received:	8/23/07
		Date Completed:	8/27/07
		Index-PCA Code:	

RE: Analysis of CFT Legumine Formulations for Benzene Sulfonic Acid

RESULTS OF CHEMICAL ANALYSIS:

CFT Legumine samples P2479-1 and P2479-4 were analyzed for benzene sulfonic acid using LC-MS. Benzene sulfonic acid was not detected in either of the CFT formulations analyzed.

Analysis Method:

The two samples were analyzed using LCMS-API-ES in negative mode. A direct injection method was employed to analyze the two samples using an Agilent 1100 LCMS. The analysis used a reverse phase C18 column in isocratic mode with mobile phase A: 75% (MeOH/water 75:25 with 0.01% formic acid) and mobile phase B: 25% (ACN). The flow rate was 0.5ml/min. Drying Gas: 13L/min, Drying Gas Temp: 300C, Nebulizer Gas Pressure: 40PSI, Cap Volt: 3500. Fragmentor Volt: 110, m/z=157(M-1) is monitored in sim and scan mode.

Lead Pesticide Chemist

Date

Laboratory Director

Date